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Reply to
Attn. of: HW-106

John Stiller
Project Coordinator
Burlington Environmental Inc.
Waterfront Place One
Suite 700
1011 Western Avenue
Seattle, Washington 98104

Re: BEI Pier 91, EPA I.D. No. WAD 00081 2917
Monitoring Well W-10

Dear Mr. Stiller:

This letter is a follow-up to Burlington Environmental Inc.'s (BEI) October 5, 1993 variance request and the subsequent November 3, 1993 meeting between BEI and the U.S. Environmental Protection Agency (EPA). At that meeting the parties discussed BEI's request to remove monitoring W-10 for both water elevations and water quality from the Pier 91 facility's groundwater monitoring program. At this time, EPA does not approve these changes. EPA's reasons for maintaining W-10 in the Pier 91 groundwater monitoring program are explained below.

Importance of W-10 to Measuring Groundwater Flow

The margin of error in W-10's dedicated bubbler measurement system is not significant enough to cause changes in the depiction of groundwater flow on the contour maps: Changing the groundwater elevation of W-10 by the measuring system's margin of error (+,-0.08'), does not significantly affect the contour maps submitted by BEI in October 1993. On the other hand, removing W-10 elevation data from the contouring database does significantly impact the direction of groundwater flow determined from the contour maps. Therefore, obtaining elevation data from W-10 is important to understanding groundwater flow at the site.

W-10 is also needed to measure flow from a recharge area present at or near CP-110. This recharge area disappears in dry months. This mound of recharge requires ground water to flow to the north and northeast back under the Marine Diesel Yard and towards W-10. This mound is present whether W-10 data is included in the contouring or not; however, W-10 data provides the detail that may more accurately reflect the shallow aquifer in this direction.

The low groundwater level measurements recorded at W-10 can not be shown to be "erroneously low" as stated by BEI. (Whether the head that is measured at W-10 represents the conditions in the upper aquifer at this location is a different question entirely which is addressed later.) If the elevations at W-10 are compared to other wells on-site, W-10 is not different from lows observed at other monitoring wells (e.g., CP-119 in April 1993, CP-118 in May 1993, and CP-111 all the time). One other means to check the significance of the W-10 data is to compare gradients between W-10 and near-by wells to gradients that exist between other on-site wells that are similarly situated. In April 1993, the gradient between CP-109 and W-10 is 0.008, whereas the gradient between CP-110 and 103A is 0.006 and the gradient between CP-110 and CP-111 is 0.009 (these well pairs are all in approximately the same upgradient/downgradient relationships in about the same approximate position in the aquifer as W-10). These gradients are all similar.

Importance of W-10 to Measure Groundwater Quality

Monitoring well W-10 is critically located to monitor groundwater quality at the site. W-10 is located along the downgradient border of the BEI Pier 91 facility and is located in an otherwise large gap between CP-103 and 108.

In addition to upgradient groundwater contamination, there is a large LNAPL upgradient of W-10. Well W-10 is well located to monitor for the extent of this plume, particularly since LNAPL has not been detected in CP-103 or 108 and if the area around W-10 is truly a low spot in the groundwater flow. The current inability to examine this well for LNAPL is a severe shortcoming of this well that may eventually require the need for a replacement well if it can not be overcome. There is plenty of reason to suspect LNAPL at this location and obtaining information about the presence of LNAPL and potential DNAPLs in this area will be necessary to complete characterization of this site.

W-10 Properly Screened

A final issue is to determine whether the W-10 well is properly screened to measure water elevation changes in the upper aquifer. Using several different means to examine this issue, EPA finds that the available information indicates that W-10 is screened in the upper aquifer. EPA's analysis follows.

The Hart-Crowser log for W-10 indicates that silty to very silty sand is present from 6' below the ground surface to below the bottom of the boring at 24' (using the ground elevation of 18 feet indicated on the boring log these depths are at elevations of +12' to -6'). The open interval (to include the filter pack and well screen) extend from 12' below the ground surface to 24'

below the ground surface (these elevations are +6' to -6' respectively). The water level that is reported for W-10 in April, 1993 is -1.43'. This elevation places the water table approximately in the middle of the open interval of W-10.

The Sweet/Edward's boring logs for CP-103B and 108A indicate the elevations for the top of the aquitard at CP-103 and 108 are -10' and -11.3' respectively. The elevation of the top of silty sand at W-10 is +12' (as stated above, 18' for the ground elevation minus the 6' to the top of the silty sand). Thus, the boring logs suggest a 22' rise and fall in the top of the aquitard surface between wells 103 and 108. This amount of rise in the aquitard surface seems unlikely based on the other elevations of the top of the silty sand layer.

If it is instead assumed that the stratigraphy between CP-103 and 108 is consistent with the other borings, the top of the aquitard at W-10 should be at about -10.5' elevation. This would place the top of the aquitard 4 to 5 feet below the base of W-10 at an elevation of -6', indicating that W-10 is monitoring the upper aquifer. In addition, if the contour map of the top of the silty sand layer that was submitted as part of the review of the April, 1992 work plan (memo of June 8, 1992) is used to project the silty-sand layer, it suggests that the elevation of the top of the aquitard should be between -12 and -13 feet or 6 to 7 feet below the bottom of the W-10 well screen. This projection would also suggest W-10 is monitoring the upper aquifer and not the aquitard.

An alternative interpretation of the stratigraphy, based on the measuring point elevation of 6.11 feet given on the water level tables in the October letter, suggests that the top of the aquitard should occur at about an elevation of -1.9 feet at W-10. This would suggest that there is an 8 to 9 foot rise in the aquitard surface at W-10. This is still not consistent with the changes in elevation for other borings nor with the boring logs for CP-103 and 108. Again using the other two borings as indicators that the aquitard surface may be at elevation -10.5 to -13 feet at the location of W-10, suggests that 2.11' to 3.61' of the open interval of W-10 is in the upper aquifer and 8 to 9 feet of the open interval of W-10 is in the aquitard. Given the hydraulic conductivity contract of 30 times suggested by BEI (i.e., the upper aquifer is 30 times more permeable than the aquitard), this would mean that almost all the head measured in W-10 is a result of the open interval in the upper aquifer. In either case, the heads measured from W-10 represent the heads of the upper aquifer at this location.

For the reasons provided above, monitoring well W-10 is currently an integral part of the groundwater monitoring system at Pier 91 and either W-10 or a replacement well in this same general location is necessary. EPA believes a replacement well

would be most useful since the construction, stratigraphy, and integrity of the well would be established, the ability to analyze for non-aqueous phase liquids provided, and it would save BEI planning and sampling time. If you have questions regarding this response, you may reach me at 553-8582.

Sincerely,

David Croxton
RCRA Permits

cc: G. Tritt, Ecology-NWRO
D. Hotchkiss, Port of Seattle